WHAT IS CLAIMED IS:

1. A system for the elastic properties measurement of a material comprising:

at least one impacting device for impacting a sample of said material so as to produce acoustic vibrations in said sample;

at least one acoustic detection device so positioned relatively to said sample and said impacting device to capture said acoustic vibrations and to produce signals indicative of said acoustic vibrations; and

a controller coupled to both said at least one impacting device and said at least one acoustic detection device for controlling said impacting device, for receiving said signals from said at least one acoustic detection device and for using said signals to determine an elastic property of the material.

2. A system as recited in claim 1, wherein said at least one acoustic detection device is a microphone of a type selected from the group consisting of electret microphone, electromagnetic microphone, and condenser microphone.

3. A system as recited in claim 1, wherein said at least one impacting device is in the form of a hammer for repetitively hitting said sample at a hitting location on said sample.

4. A system as recited in claim 1, wherein said controller is a main controller and at least one of said at least one impacting device

and said at least one acoustic detection device is coupled to said main controller via a input/output (I/O) controller.

5. A system as recited in claim 4, wherein said I/O controller is adapted a) to receive said signals indicative of said acoustic vibrations from at least one acoustic detection device, b) to calculate period values from said received signals, and c) to send said period values to the main controller to determine said elastic property of the material.

6. A system as recited in claim 4, wherein said I/O controller includes an analog to digital converter provided with timing means.

7. A system as recited in claim 4, wherein said I/O controller is adapted to selectively trigger said at least one impacting device.

8. A system as recited in claim 1, further comprising a mounting table to position said at least one impacting device and said at least one acoustic detection device near said sample for measuring said sample.

9. A system as recited in claim 1, wherein said at least one impacting device and at least one acoustic detecting device being positioned relatively to said sample for at least one of i) flexural testing in a first direction relatively to said sample, ii) flexural testing in a second orthogonal direction relatively to said first direction, iii) longitudinal testing,

and iv) torsional testing.

10. A system as recited in claim 9, wherein said sample is a rectangular beam having two longitudinal end surfaces; said at least one impacting device being positioned at about 0.21 L_o from one of said two longitudinal end surfaces for said flexural testing in a second orthogonal direction relatively to said first direction, where L_o is the length of said beam.

11. A system as recited in claim 9, wherein said sample is a rectangular beam having two longitudinal end surfaces; said at least one acoustic detection device being positioned at about 0.21 L_o from one of said two longitudinal end surfaces for said torsional testing in a second orthogonal direction relatively to said first direction, where L_o is the length of said beam.

12. A system as recited in claim 1, further comprising display means connected to said controller for displaying at least one of said elastic property and said signals indicative of said acoustic vibrations.

13. A system as recited in claim 1, wherein said controller includes means for storing data related to at least one of said elastic property and said signals indicative of said acoustic vibrations.

14. A system as recited in claim 1, wherein said at least one impacting device includes an impacting tip; said system further comprising a high-temperature resistant casing including lining for

receiving said impacting tip; said system further comprising at least one ceramic waveguide mounted to said casing for receiving said at least one acoustic detection device through said lining of said casing.

15. A system as recited in claim 14, wherein said high-temperature resistant casing being in the form of a furnace for heating said sample.

16. A system as recited in claim 14, wherein said impacting tip is the form of a rod or a tube.

17. A system as recited in claim 16, wherein said tube has a closed end defining said impact tip having a radius of curvature similar to said tube diameter.

18. A system as recited in claim 14, wherein said ceramic is selected from the group consisting of mullite, silicon nitride, silicon carbide and boron carbide.

19. A system as recited in claim 1, wherein the material is homogeneous.

20. A system as recited in claim 19, wherein said homogenous material is a fine ceramic or a metal.

21. A system as recited in claim 1, wherein the material is heterogeneous.

22. A system as recited in claim 21, wherein said heterogeneous material is a refractory or a carbon electrode.

23. An impacting device for causing vibration of a sample of a material in view of measuring an elastic property of the material, the device comprising:

an impacting tip defining a longitudinal axis; and

an actuator for moving said impacting tip along said longitudinal axis; said impacting tip being mounted to said actuator via a rod.

24. An impacting device as recited in claim 23, wherein said impacting tip is in the form of tube.

25. An impacting device as recited in claim 23, wherein said impacting tip is in made of ceramic.

26. An impacting device as recited in claim 23, wherein said impacting tip defines an impact surface which is greater than a maximum defect size in the sample.

27. An impacting device as recited in claim 23, wherein said actuator includes two solenoid activators coupled in series and a ferromagnetic core coaxially mounted within said two solenoid activator for reciprocal movement therein;

whereby, in operation, passing an electric current through said two

solenoids induces a magnetic field which causes displacement of said core along said longitudinal axis.

28. An impacting device as recited in claim 23, further comprising a damping assembly for limiting said tip to a single impact following a triggering of said impacting device, thereby preventing resonant acoustic signal contamination.

29. An impacting device as recited in claim 28, wherein said two solenoids have an electrical excitation duration, strength and synchronization yielding sufficient time for oscillation attenuation of the impacting tip and retraction of said impacting tip.

30. An impacting device as recited in claim 28, wherein said damping assembly includes a spring mounted at the end of said rod coaxially thereon near said core, and two stoppers for limiting the longitudinal course of said rod; said two stoppers being fixedly positioned in relation to said two solenoids so that each of said two stoppers is positioned near a respective longitudinal end of said two solenoids.

31. An impacting device as recited in claim 23, further comprising at least one support for supporting said intermediate rod.

32. An impacting device as recited in claim 31, wherein said support is made of a low-friction material.

33. An acoustic detection device for elastic properties

measurement of material comprising:

a shock-resistant container;

an electret microphone for measuring elastic properties of the material; said electret microphone being mounted in said container via an intermediate shock-absorbent material; and

an electric connection for coupling said electret microphone to a controller.

34. An acoustic detection device as recited in claim 33, wherein said shock-resistant container is in the form of a metallic casing.

35. An acoustic detection device as recited in claim 33, further comprising a waveguide secured to said casing so as to extend therefrom for mounting said microphone to said casing.

36. An acoustic detection device as recited in claim 35, wherein said waveguide is in the form of a tube; said tube having a length at least about ten times an inner area thereof.

37. An acoustic detection device as recited in claim 36, wherein said electret microphone defines a receiving area; said tube having an aperture greater or equal to said receiving area.

38. A method for determining the resonance period of a material, said method comprising:

i) providing a plurality of period values obtained by measuring vibrations of a sample of the material during repetitively

impacting said sample of the material;

ii) providing an analysis resolution;

iii) grouping said period values into a current series of groups of period values defined by said analysis resolution;

iv) determining the population of period values in each of said groups in said current series of groups;

v) providing an acceptability level;

vi) selecting a subsequent series of groups among said current series of groups, yielding selected groups; said selected groups in said subsequent series of groups having a population equal or greater than said acceptability level;

vii) verifying whether said subsequent series of groups include more than two groups;

viii) if said subsequent series of groups include more than two groups then viii) a) increasing said analysis resolution, viii) b) defining said subsequent series of groups as said current series of groups, and viii) c) repeating steps vi) to viii);

ix) creating a final group of period values including all the period values from said subsequent series of groups and period values from step i) falling within one of said subsequent series of groups; and

x) determining the average of said final group of period values.

39. A method as recited in claim 38, further comprising xi) displaying said plurality of period values provided in step i) in the form of a visual representation on a display device; said visual representation being indicative of whether at least one of said plurality of period values is

included in said final group.

40. A method as recited in claim 39, wherein said visual representation is a graph or a table.

41. A method as recited in claim 38, wherein said analysis resolution is set to 2 bits in step ii).

42. A method as recited in claim 38, wherein said analysis resolution is increased by 1 bit in substep viii) a).

43. A method as recited in claim 38, wherein said acceptability level is calculated by multiplying the highest population among said population of period values in each of said groups by a predetermined ratio.

44. A method as recited in claim 43, wherein said ratio is about 1/3.

45. A method as recited in claim 38, wherein in step viii) c) verifying whether said analysis resolution is greater than a maximum resolution; if said analysis resolution is greater than a maximum resolution than proceeding with step ix).

46. A method as recited in claim 45, wherein said maximum resolution is 15 bits.

47. A method for characterizing cracks in a material comprising:

a) providing a sample of the material in the form of a rectangular block of material having a height h;

b) measuring the natural flexion resonance period T_1 of said sample along its height;

c) measuring the natural flexion resonance period T_2 of said sample along its width; and

d) computing an equivalent equidistant and uniform length of cracks in the material "a", such that the distance between said cracks is equal to or lower than said length; wherein

$a = \text{abs}[h \times (1 - (T_1 / T_2))]$.